

## IMPACT OF MACROECONOMIC FACTORS ON NIFTY 50

**Dr. RASHMI SONI**

K J Somaiya Institute of Management, Mumbai India. Email: Rashmi.soni@somaiya.edu

**Dr. SRIJANANI DEVARAKONDA**

Vignana Jyothi Institute of Management, Hyderabad, India. Email: dsrijanani@yahoo.com

**Dr. MADHAVI ISHWAR DHOLE**

SIES College of Management Studies, Nerul, Navi Mumbai, India. Email: madhavid@sies.edu.in

### Abstract

Stock Markets reflect the sentiment of the investors towards the economy as whole. Whenever there are any policies or changes impacting the economy, the investors tend to modify their investing strategies which can be reflected in the stock market output. In this paper, we will be looking at the impact of 6 selected macroeconomic factors inflation in terms of CPI, economic growth in terms of IIP, Repo Rate, Exchange Rate in terms of USD/INR, Gold Price per 10 grams and 10 Year Bond Yield on the index, NIFTY 50. These factors broadly cover the macroeconomic factors and these factors are key variables which cause changes to the behaviour of investors. Univariate and Multivariate tests and models are used to determine the impact of macroeconomic factors on NIFTY 50. Multivariate model needs to be considered because the variables are time series. Test like unit root test, VAR model, co-integration test and causality test used for analysis. For Univariate, correlation and linear regression model are used. This study help us to understand how changes in the macroeconomic environment affects the investors' sentiments which in turn affects the stock market output. The conclusion will also help us predict on how a new investor can go long or short in the stock market when the macroeconomic results are expected or announced.

### INTRODUCTION

The seminal study in the field of identifying the variables responsible for the movement of the stock markets can be regarded to be Fama (1970) landmark research work, in which he categorised market efficiency into three levels, namely the weak, semi-strong, and strong forms. It is a well-known fact that there are a plethora of variables that affect stock prices, including not only corporate information but also political news, global cues from other major exchanges, movements in the price of oil, gold, and other commodities, as well as performance related to the macroeconomic fundamentals of the economy, such as inflation, employment, interest rates, GDP, industrial production, etc.

Today most investments go towards the capital market and right at the centre of it all are the stock markets. Stock markets play a major role in the economy of the country. They push the agenda of financial and economic growth. The emerging economy of India is captured perfectly in the volatility of the stock market. The humungous volumes of stocks being traded on daily basis through BSE and NSE tell about the involvement of investors in the markets. These investors are the driving figures towards how the stock market is going to perform on that particular day. And behind these investors are the various reasons which affect whether the market will be bullish or bearish.

IPOs and FPOs play a huge part for raising capital for companies. And investors are eager to gain shares in these companies. Continuous trading of these securities takes place based on various viewpoints - results by a company, growth aspects of the company, factors related to the government of the country, natural factors (COVID), future possibilities with regards to the company and/or the industry and most importantly, outlook towards the economy as a whole. The sentiments of the traders towards all these aspects are mirrored in the stock market.

Investors react towards the various changes in the economy, and this is reflected in the stock market sentiment. The changes in the economy are due to various factors that affect the microeconomic facts (consumer goods & services demand & supply) or macroeconomic factors. The macroeconomic factors affect the liquidity in the economy, which affects the investing patterns. These factors range from economic growth to inflation to commodity prices to the prevailing interest rates. And at the back of these factors is the government and central bank controlling them.

In this paper we are going to consider selected macroeconomic factors. Inflation is a factor which directly affects the purchasing power of the consumer which in turn affects their investments. The repo rate will affect the liquidity injected by the central bank in the overall banking system. The economic growth can be seen through the IIP (Index of Industrial Production) which gives the growth seen in output of various industries. The next factor we will see is the exchange rate which has become a huge consideration ever since our country opened to Liberalization, Globalization and Privatization. The 10 year bond yield will change how the investor sees the returns realizable from the stock markets. The commodity we will consider is gold as it is seen as an alternative investment by the people in India.

The effect of these factors on the stock market can be studied through the effects seen on the stock market index NIFTY 50. NIFTY 50 comprise of 50 of the largest companies listed on NSE and covers major industries. So it forms an efficient portfolio of the industry as whole and gives us a brief idea of how the macroeconomic factors affect the stock market.

## LITERATURE REVIEW

The relationship between macroeconomic factors and stock returns has been extensively studied in the literature. Despite inconsistent findings, the majority of studies have shown evidence of a connection between macroeconomic factors and stock returns. Chen et al. (1986) in their paper provided a foundation for future research in this area. As they describe it, "simple and intuitive financial theory" is a well-known literary expression. Innovations in variables can be used to measure economic news. They made an effort to investigate the group of economic factors that consistently affect asset price as well as stock returns.

Macro factors and stock markets are closely related, and macros to some extent determine whether market mood is bullish or bearish. Notwithstanding Listed company's expansion aspirations, investors continue to pump money into the markets. Stock markets display a rising upward trend when the economy is growing in terms of macro indices (interest rates, currency rates, GDP growth, industrial production, etc.), as there is all-around excitement as positive

news keeps on coming in at regular intervals. Osamwonyi, I. O et.al. (2012); Rahman, et.al. (2009); Sohail, N., & Hussain, Z. (2009); Lee, M., & Gan, C. (2006); Chen et al (2005); Hooker, (2004); Gjerde et. al. (1999) & Fama and French, (1988) in their studies have found a positive relation between the macro-economic variables and stock market.

Robert (2008) studied the effects of macroeconomic variables on the stock market of BRIC Nations. He has taken into consideration two factors – foreign exchange rate and oil price. Along with this the author has also assessed the market efficiency of BRIC nations which can allow investors to assess market risk. He used ARIMA model to assess the relationship. He observed that the relationship was not significant because along with exchange rate and oil prices, there are multiple economic factors which go hand in hand to determine the stock market pricing. Also the significance level for each country in the BRIC nations differed. The author comments that there should be more macroeconomic variables that need to be considered and the study should be taken forward accordingly.

Mahedi (2012) has studied the impact of macroeconomic variables on stock market for two developed economies of UK and Germany. He has considered money supply, exchange rates, Treasury bill rates and bond rates. The author has checked the impact using VECM model, causality test and co-integration test. The author found that there are short run implications and long term relationships between the macroeconomic factors and stock markets. Through variance decomposition test, the author found out that the relationship in short run is weaker and the stock prices can even be determined using just historical stock prices. Using Impulse Response function, the author determined that the effects of factors on the index gets corrected in the long run.

Paolo Mauro (2000) has done research on the correlation between economic output growths and lagged stock return. He considered two factors in output growth – Private Credit Growth and Broad Money Growth. He has used Panel Regression model to determine the relationship. The research proves that there is a significant positive correlation between the economic output growth and the stock returns though it varies from country to country depending on whether it is developed or developing.

Chen et al (1986) were talking about how the risks associated with the changes in macroeconomic factors can be realized in the returns associated with the stock markets. The authors realized that industrial production, inflation, bond yields and risk premiums are the factors which showed significant impact on the stock returns. Whereas oil prices had insignificant impact. The study was carried through correlation matrix and multivariate approach.

Satyanarayana et al (2018) have looked into the effect of inflation on stock market returns and observed that it is positive for certain countries and positive for others. They used unit root test to check for stationarity and Pearson Correlation Coefficient for checking the relation between the two variables. The negative correlation was found significant. So the authors have concluded that higher inflation rates decrease investments in turn decreasing the stock market returns. Harpreet (2015) has checked the relationship between inflation (CPI) and NIFTY. The

model used by the author is regression. The author concluded that there exists a negative relationship between inflation and NIFTY 50 and higher inflation rates are not good for stock market returns.

Sahu (2020) examined the relationship between stock market indices NIFTY & Sensex and IIP (Index for Industrial Production). Stock markets help in industrial growth by being a way to raise capital. In this research, the author has conducted unit root test, co-integration test, causality test and VECM (vector error correction model) to check for relationship between IIP and the stock market indices. The result through the VECM model states that short run IIP does not affect the stock market indices, but the reverse is true. The stock market is sensitive to IIP in the long run.

Maryam et al (2018) discussed about the relationship between gold price and stock market during pre, during and post financial crisis period using unit root test, co-integration test and causality test. In pre-crisis period there was strong positive relationship which was changed to strong negative post crisis. This was so because investors started looking at gold as alternative safer investment to stocks. Through the co-integration test, it was determined that there is a long term relationship between gold prices and stock market.

Salahuddin et al (2010) have discussed how change in interest rate occurs due to monetary fiscal policies which in turn affects the stock market. They have used unit root test and ordinary least square regression to study the impact of interest rate on stock market. The authors reached the conclusion that there is a negative relationship between these two variables and the government needs to keep the interest rates in control or it will have a negative impact on the stock markets.

## **RESEARCH METHODOLOGY**

### **Objective**

The following study will help us to understand how changes in the macroeconomic environment affects the investors' sentiments which in turn affects the stock market output. The conclusion will also help us predict on how a new investor can go long or short in the stock market when the macroeconomic results are expected or announced.

Since the objective of the research is to study the impact on the stock market, we have chosen NIFTY 50 which acts as an efficient portfolio of all the industries constituting the market. Now to study the effects of macroeconomic factors, we need to select the factors in such a way that they can broadly describe the effects of macroeconomics as whole on the stock market. Macroeconomics as whole consists of factors affecting private consumption, government spending, investments and trade. So we consider variables which affect these 4 components. The consumption is affected by the inflation and government spending is impacted by economic growth. The investment is affected by the repo rate, gold price and 10 year bond yield. The trade element is impacted by the exchange rates.

To broadly define, the objective of this research is – To study the impact of the following macroeconomic variables on NIFTY 50:

1. Inflation – CPI
2. Economic Growth – Index of Industrial Production
3. Repo Rate
4. Exchange Rate – USD/INR
5. Gold Price per 10 grams
6. 10-year Bond Yield

### **SCOPE OF STUDY**

To understand the relevance of each of the above mentioned variables as to what part the play while impacting the stock market index NIFTY 50. We have conducted various tests to understand the relationship between the macroeconomic variables and Stock Market with using NIFTY 50 index as stock market proxy.

To conduct the analysis, monthly data has been taken for each variable from January 2012 to December 2020 (108 observations). The data has been sourced from:

1. NIFTY 50: Yahoo Finance
2. Inflation – CPI: OECD
3. Economic Growth – Index of Industrial Production: MOSPI Database
4. Repo Rate: RBI NSDP
5. Exchange Rate – USD/INR: Trading Economics
6. Gold Price per 10 grams: GoldHub
7. 10-year Bond Yield: Investing.com

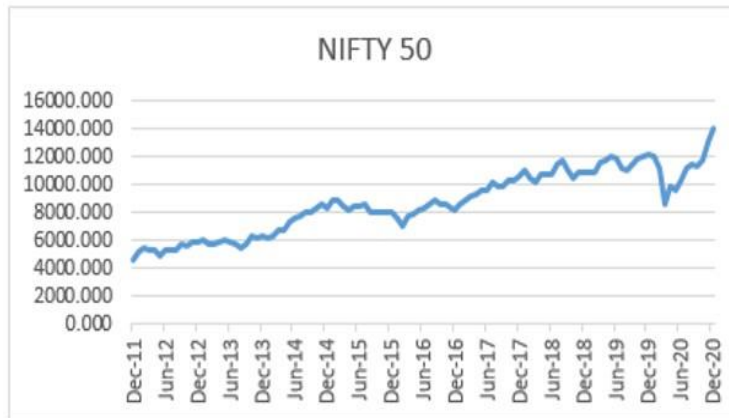
Various relations have been studied through the tests for correlation, regression, stationarity (Unit Root Test – ADF Test), causality & two way causality (Granger Causality Test) and long term impact (Johansen's Co-integration Test).

### **VARIABLES**

#### **Stock Market Index – Nifty 50**

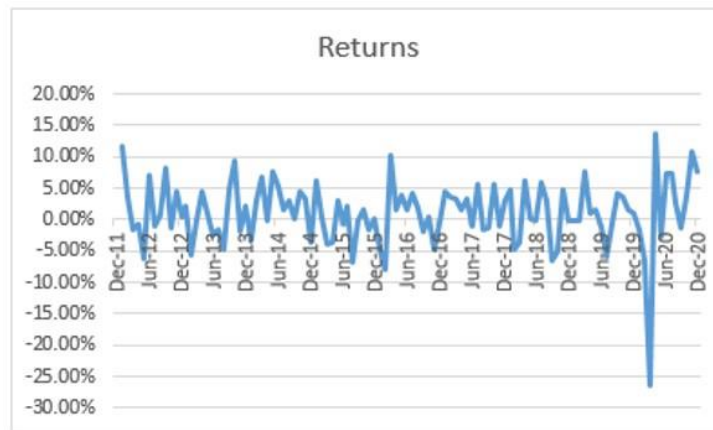
To study the effects of the macroeconomic factors on the stock market we need to consider a variable to represent the stock market output. Here we have considered the NIFTY 50 Index. NIFTY 50 is Indian stock market benchmark index representing the weighted average of free float market capitalization of 50 largest companies listed on NSE (National Stock Exchange). NIFTY 50 covers all major sectors in the economy and forms one efficient portfolio which can

be used to understand the overall exposure an investor will have. We have taken the NIFTY 50 monthly index value from January 2011 to December 2020 from Yahoo Finance.



**Figure 1: NIFTY 50 Adjusted Close: 2012 to 2020**

The above figure shows the NIFTY 50 values from January 2012 to December 2020. We can see through the dips and highs over the months reflecting the stock market sentiment because of various on goings in the economy as whole. We can see how there is a major dip in March-April 2020 due to COVID 19 and how the market is in correction post the dip which is seen in the upward trend observed in the months following. It is not just the domestic factors which affect the market sentiments but also the foreign factors as it can be seen in 2016, there were 2 dips as Donald Trump was elected as President. This event was expected to affect the trade relations, exchange rate and FIIs which was reflected in the index as it fell.



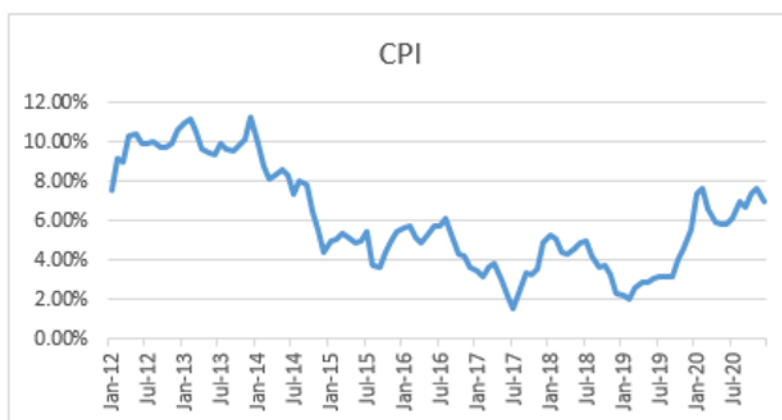
**Figure 2: NIFTY 50 Returns**

As the NIFTY 50 index is a non-stationary time series, we calculate returns to get a stationary time series. Here we can observe the severity of the highs and lows seen across the period from 2012 to 2020. As observed the dip seen in March-April 2020 was the worst but as time went on we see a spike of recovery in the second quarter of FY21.



### Inflation – CPI

One of the macroeconomic variable we are considering is Inflation which is measured in terms of Consumer Price Index (CPI). CPI basically measures the change in the money required to buy a fixed basket of consumer goods & services. Increase or decrease in inflation directly affects the purchasing power of a consumer which in turn affects the investing patterns of that consumer.

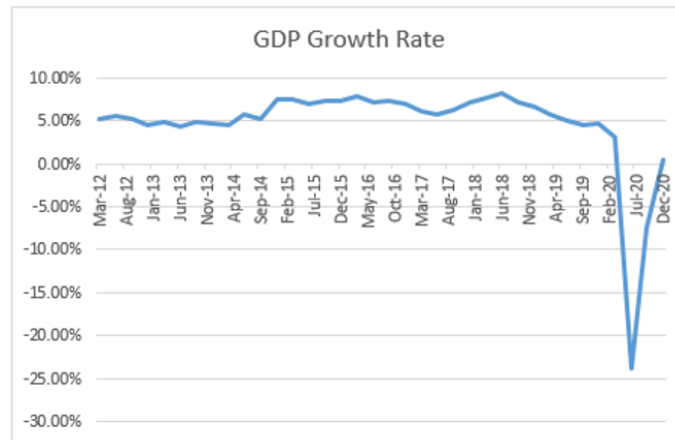


**Figure 3: Inflation – CPI**

The chart gives the inflation values seen from January 2012 to December 2020 measured by CPI. Government maintains a certain level of inflation to maintain the goods demand and supply equilibrium in the market. Government can control inflation by controlling the money supply in turn affecting the purchasing power of the consumers. When the purchasing power and consumption power of the consumer increases, the demand for the goods & services increases which in turn makes the companies to increase prices as the demand is more than supply. This causes inflation. Since consumers are spending more of these goods & services, they tend to save and invest less which causes a negative sentiment in the market. So there is negative correlation between the NIFTY 50 index and inflation.

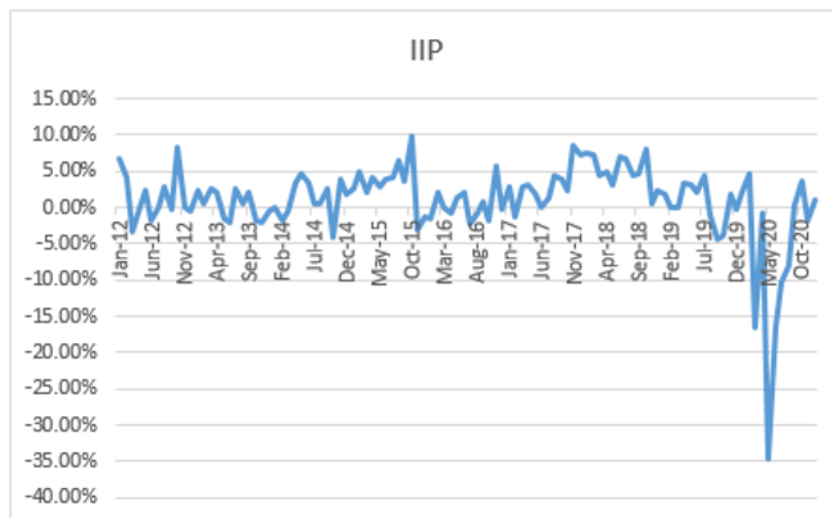
### GDP & IIP

The major macroeconomic indicator is the economic growth of the particular country. In India we measure it using GDP (Gross Domestic Product). GDP constitutes of personal and government consumption expenditure, investments and net exports of the country. Positive growth in GDP due to incoming investments and government spending can lead to development in the industry which can lead to increase in the share prices due to positive results by the company and increasing positive sentiment in the market.



**Figure 4: GDP Growth Rate**

GDP growth rate is released every quarter. As the variables we have taken are on monthly basis, so we consider IIP (Index of Industrial Production) which is an index that gives the growth rate of various sectors in the economy. Increase in the IIP means that there is an increase in the production in the industrial sector which would lead to increase in the share price and market capitalization leading to increase in the stock market index value.



**Figure 5: IIP Growth Rat**

### Repo Rate

The rate at which RBI lends money to other banks for a short period is Repo Rate. Change in repo rate can directly impact the liquidity in the economy. As we know higher the liquidity, higher is the investment. So if the repo rate decreases, the banks can borrow money at a lower rate from RBI and banks will borrow bigger sums. This in turn will increase the liquidity and banks will have more money to lend, which companies will borrow and invest in the growth of



the companies. This will obviously increase the share price of the company because of higher profits and growth. So NIFTY will also increase.

But if the repo rate is increased, it will lead to reduced liquidity in the market, so banks have less money to lend. Which in turn will lead to increase in the interest rate on loans. So companies tend to borrow less so investments are less. So this can lead to negative impact on the stock market.

So repo rate will have a negative relationship with NIFTY 50.

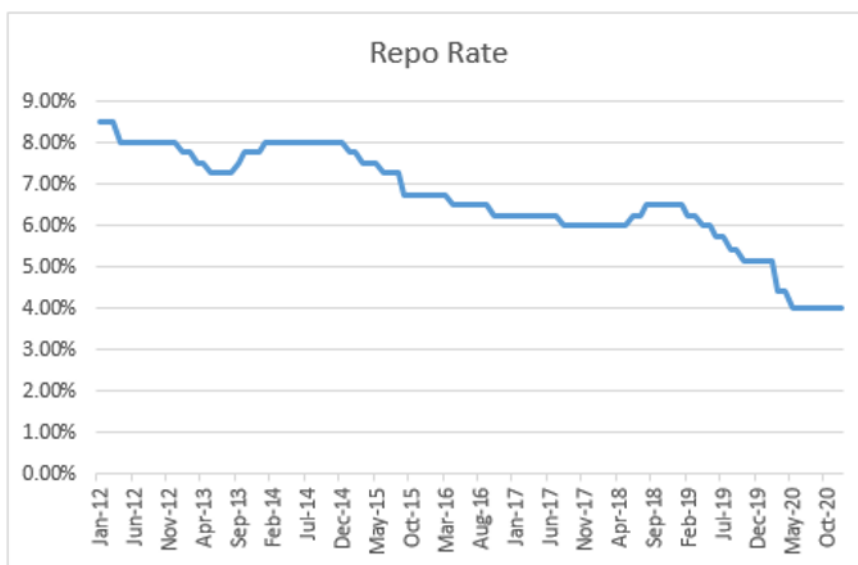
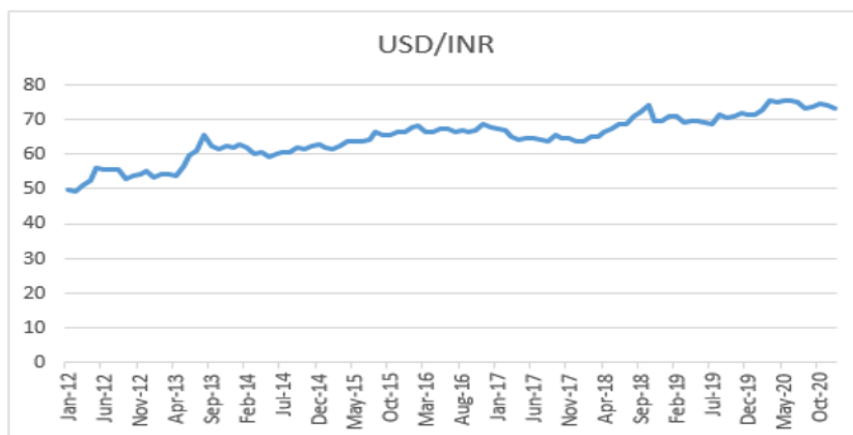


Figure 6: Repo Rate

### Exchange Rate – USD/INR

Currency exchange rates play a major part while studying the macroeconomic factors as all the trading activities are associated with it. Not only trading activity, it affects the dollar reserves and consolidated businesses of all the multinational companies. The rate affects the FIIs and FDIs which in turn have a huge impact on the stock market. We are considering Dollar exchange rate as US Dollar is used in most of the above mentioned transactions and is the most dominating foreign currency in all aspects related to the economies of the world.

Exchange rate effects on the stock market are mixed as import oriented companies can be benefitted from a strong domestic currency but export oriented companies are affected negatively. Similarly, depreciating domestic currency can be a sign of incoming inflation which will have a negative impact on stock market. So it forms a complex relationship between the dollar rate and the stock market. We further observe that if dollar appreciates, the NIFTY 50 shows positive impact. The probable reason could be presence of all the multinational companies in the NIFTY 50 portfolio.



**Figure 7: USD/INR Exchange Rate**

### Gold Price

Gold Price is an important macroeconomic factor to consider as gold in India is considered as a major investment and sometimes even a substitute to the usual investments in capital or money markets. So an increase in the gold price means that Indians are investing more in gold which means they are going to tend to investing less in the stock markets. This can be because the investors are expecting stock markets to be unreliable in the coming times or can be a sign of inflation so this indicates that the economy is not doing well. When gold prices fall, it means that the investors are tending more towards the capital and money markets i.e. their sentiment is positive towards the economy.

So we can say that there exists a negative relation between NIFTY 50 and gold prices.



**Figure 8: Gold Prices per 10 grams**

## 10 Year Bond Yield

Bonds, even though debt securities, have an impact on the stock markets. Bond yield is how much return an investor will get on that bond. 10 Year Bond yield is considered basically as risk free returns by investors. So when investors feel that this yield is higher as compared to the returns they are expecting from stock market, they put their money more in bonds which has a negative impact of the equities market. Higher bond yields can attract FIIs in debt market more. Long term bond yields also tend to increase when there is inflation in the economy. So equity markets perform better when long term bond yields are low and vice versa. We can observe a negative relation between the 10 year bond yield and NIFTY 50.

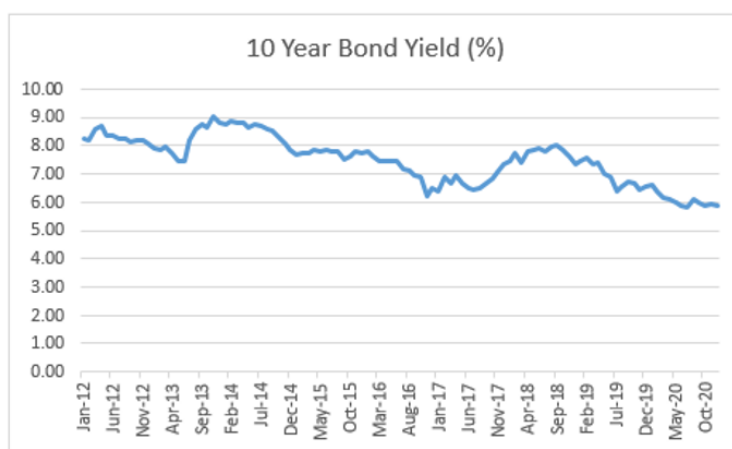


Figure 9: 10 Year Bond Yield – India

## TESTS & MODELS FOR DATA ANALYSIS

To understand the impact of the various macroeconomic factors on NIFTY 50, I will be doing various tests to check the relationship between the variables and derive conclusions accordingly. I will be using SPSS and EViews to conducted this analysis and review the inferences to conclude regarding the impact of the variables.

### SPSS - Correlation

To determine the strength of relationship between NIFTY 50 and other variables, we will be using Correlation Analysis in SPSS. The value for correlation will lie in between -1 to +1. Correlation means how one variable is reacting in accordance to the other variable. So if the value is +0.8 to +1 then there exists a strong positive correlation between 2 variables, i.e. if one variable increased then the other also increases. If the value is -0.8 to -1 then there exists a strong negative correlation between 2 variables, i.e. if one variable decreased then the other also decreases.

We are using Karl Pearson coefficient of correlation, where the coefficient measures the strength of relation between linearly related variables.

## **SPSS - Regression**

In SPSS we will be checking for a linear regression equation between NIFTY 50 (Dependant Variable) and macroeconomic factors (Independent Variables). After we execute regression function in SPSS, we get various output tables which can be used to draw several inferences.

We obtain an equation too show how NIFTY 50 can be expressed in terms of the macro economic factors. We can check the significance of the coefficients using the p value and determine which variables play more significant role as compared to other variables. By checking the R-Square (coefficient of determination), we can determine what amount of variations in NIFTY 50 can be explained by the macroeconomic factors.

## **EViews - Unit Root Test (Augmented Dickey-Fuller (ADF) Test)**

When we analyze time series data, the most important aspect that needs to be considered is the stationarity of the data for coming up to any inferences and conclusions to ensure that relationship between the variables is not invalid. A time-series data is said to be stationary if the data has a constant mean, variance and auto-covariance for each time lag. This means that the statistical measures are constant for the extreme time periods and do not depend on the actual period when they were computed but only on the time lag between the extreme periods. When the data is non-stationary then the results produced may give biased estimators. These results will be unreliable and inaccurate for any analysis. We use Unit Root Test to check if the variable data is stationary or not. We will be using the Augmented Dickey-Fuller (ADF) test. Augmented Dickey - Fuller (ADF) test is connected to check stationarity. So as to check stationarity properties of time series, we have utilized Augmented Dickey Fuller (ADF) test. Stationarity of information is an essential for conduction of regression. These trials of unit root have the null hypothesis of quality of unit root in the data, which means the data is non-stationary. The stationarity of the data in both the tests have been checked at both log levels just as at their first contrasts.

## **EViews - Johansen's Co-integration Test**

Now through unit root test, we will realize that there is non-stationarity to level 1. How do we find the impact in such a case can be answered through the Johansen's Co-integration test. This test will basically help us find out if there is a long run relations between the variables. This is generally observed in time series data. The dependent variable also depends on the lags of variables. Here we study two tests – Trace Test & Maximum Eigen value Test. Trace test checks the null hypothesis that the number of unique co-integrating vectors is less than or equal to a certain number of results. Whereas the maximum eigenvalue test check for the null hypothesis of exactly  $r$  co-integrating relations against the alternative of  $r + 1$  co-integrating relations with the test statistic.

## **EViews - Granger's Causality Test**

Since these variables are clearly interrelated, we can use the Granger's causality test to find which variable is responsible for causing the other variable. If one variable is significantly responsible for causing another variable, then we can say that variable 1 Granger causes

variable 2. Since we are using time series, it also implies that not only the variable but also its lagging values are significant in explaining the variable 2. The null hypothesis in this case is variable 1 does not Granger cause variable 2 and on the basis of the p value can be accepted or rejected based on the significance level.

## DATA ANALYSIS

### Correlation Test

As discussed earlier, we will be checking for correlation between NIFTY 50 and the macroeconomic factors. We use the Bivariate Correlation option in the Analyze tab of SPSS. We select Pearson Correlation Coefficients and two tailed significance.

The following result is observed:

		Correlations						
		NIFTY 50	CPI	IIP	USD/INR	Repo Rate	Gold Price per 10 grams	10 Year Bond Yield
NIFTY 50	Pearson Correlation	1	-.715**	.003	.815**	-.802**	-.491**	-.621**
	Sig. (2-tailed)		.000	.974	.000	.000	.000	.000
	N	108	108	108	108	108	108	108

\*\* . Correlation is significant at the 0.05 level (2-tailed).

**Figure 10: Correlation Test in SPSS**

Based on the results table, we can see that there is a strong positive correlation between NIFTY 50 and Exchange rate. The correlation is significant at 5% level of significance. This means that as the dollar appreciates, the index performs better.

We observe strong negative correlation between Inflation & Repo Rate and NIFTY 50. The correlation is significant at 5% level of significance. This means that NIFTY performs better i.e. the market performs better when the inflation level and repo rate is reduced as there will be more liquidity in the market which would lead to more investments.

The correlation is medium negative between the Gold prices & 10 Year Bond Yield and NIFTY 50. The correlation is significant at 5% level of significance. This means that stock market investments and gold investments have inverse relationship, i.e. when there is a negative sentiment in the market, the investors tend to invest in gold more. The stock market returns seem more attractive when the 10 Year Bond Yield is low which is considered as risk free returns.

Lastly we observe very weak positive correlation between IIP and NIFTY. The correlation is not significant. So the index is not significantly impacted by IIP.

### Regression

We will be checking for linear regression equation between NIFTY 50 and the macroeconomic factors. We use the Regression option in the Analyze tab of SPSS. While drawing conclusions based on the result, we will be checking the Coefficients and Model Summary tables.

The first table below is the table of the coefficients. From this table we get the coefficient values for each of the macroeconomic factors to form a linear regression equation. The

significance values tells which variable impacts the index NIFTY 50 the most. As observed in the table below, we can see that CPI, IIP and Gold price have the least p value, equal to zero. So these 3 variables have the strongest impact in the linear regression equation, followed by Repo Rate and 10 Year Bond Yield. Exchange rate has the highest p value, even above the 5% significance rate.

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5236.036	3411.039		1.535	.128
	CPI	-435.527	59.181	-.511	-7.359	.000
	IIP	95.362	17.656	.231	5.401	.000
	USD/INR	50.436	31.810	.143	1.586	.116
	Repo Rate	-820.319	254.599	-.443	-3.222	.002
	Gold Price per 10 grams	.127	.032	.343	3.962	.000
	10 Year Bond Yeild	558.630	181.143	.232	3.084	.003

a. Dependent Variable: NIFTY 50

**Figure 11: Regression in SPSS - Coefficients Table**

The next table that we observe in the Regression Analysis is the Model Summary. In this table we look at the Coefficient of Determination, i.e. R square. Since this equation has multiple independent variables, we will consider Adjusted R Square. So it can be seen that 85.4% variations in NIFTY 50 can be explained using the variations in the macroeconomic factors. The standard error observed is very high, as we know that these are time series variables. So there will be further tests required to determine the relationship and not just a simple linear regression.

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.928 <sup>a</sup>	.862	.854	849.528

a. Predictors: (Constant), 10 Year Bond Yeild, IIP, CPI, USD/INR, Gold Price per 10 grams, Repo Rate

**Figure 12: Regression in SPSS - Model Summary Table**

## E Views

### Unit Root Test (Augmented Dickey-Fuller (ADF) Test)

As we have taken time series data, we have to check for stationarity. Along with that, if the data is non-stationary, we have to check at which difference level it becomes stationary. For this we will be using Unit Root Test in EViews. We will be checking this test for each variable and summarizing the output in a table below.



Variables	At Level		At 1st Difference	
	t-statistic	p-value	t-statistic	p-value
NIFTY 50	-0.345678	0.9132	-9.801668	0.0000
CPI	-1.886870	0.3373	-7.107034	0.0000
IIP	-3.705407	0.0053	-19.11426	0.0000
Repo Rate	-0.162122	0.9378	-5.469992	0.0000
Exchange Rate	-2.080173	0.2531	-10.27017	0.0000
Gold Price	1.159536	0.9978	-8.174497	0.0000
10 Year Bond Yield	-0.703436	0.8406	-10.10920	0.0000

**Figure 13: Unit Root Test Results**

In Unit Root Test, the Null Hypothesis is that the variable has unit root i.e. the variable is stationary. As observed through the test, all the variables are non-stationary at level as the null hypothesis cannot be reject because the p-value is greater than 0.05. But the variables become stationary at 1st Difference because p-values are less than 0.05. So we can conclude from this that normal linear equation is insufficient to determine impact of macroeconomic variables on NIFTY 50. We need to conduct co-integration test to realize the number of co-integration equations.

**Selecting Lag Level & VAR Model**

Before we go to co-integration test, we need to check for the lag level to be taken. This is needed to create a VAR model to describe the dynamic behaviour scene in case of variables with time series. This model acts as a multivariate substitute to the univariate linear regression which is necessary for time series variables.

We will select the Lag Level in EViews. The Table for the same is displayed below.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1299.101	NA	521.5903	26.12202	26.30438	26.19582
1	-596.9319	1291.991	0.001109	13.05864	14.51753*	13.64908*
2	-544.2833	89.50267	0.001045*	12.98567	15.72109	14.09274
3	-500.8908	67.69231	0.001211	13.09782	17.10978	14.72153
4	-445.0371	79.31220	0.001131	12.96074	18.24924	15.10109
5	-411.2750	43.21555	0.001724	13.26550	19.83053	15.92248
6	-348.5461	71.51088*	0.001572	12.99092	20.83248	16.16454
7	-287.6271	60.91901	0.001625	12.75254	21.87064	16.44280
8	-230.0196	49.54243	0.002031	12.58039*	22.97502	16.78729

\* indicates lag order selected by the criterion  
 LR: sequential modified LR test statistic (each test at 5% level)  
 FPE: Final prediction error  
 AIC: Akaike information criterion  
 SC: Schwarz information criterion  
 HQ: Hannan-Quinn information criterion

**Figure 14: Lag Length Criterion**

For selecting the lag length, we have considered Schwartz Information Criterion, Hannan-Quinn Criterion and FPE Criterion to cover majority of the criterion. So we select 2 lag level. Using this we then create VAR model which is shown below.

Vector Autoregression Estimates  
Included observations: 106 after adjustments  
Standard errors - ( ) & t-statistics - [ ]

	NIFTY_50		NIFTY_50	
NIFTY_50(-1)	0.885762 (0.12960) [ 6.83439]		_10_YEAR_BOND_YEILD(-1)	242.3148 (229.266) [ 1.05892]
NIFTY_50(-2)	-0.137582 (0.12824) [-1.07285]		_10_YEAR_BOND_YEILD(-2)	175.0025 (250.424) [ 0.69862]
CPI(-1)	-19367.25 (7839.96) [-2.47032]		C	-183.4111 (2022.10) [-0.08081]
CPI(-2)	1316.029 (7840.99) [ 0.16784]		R-squared	0.966151
			Adj. R-squared	0.960944
			Sum sq. resids	17051910
IIP(-1)	-398.2196 (1121.53) [-0.35507]		S.E. equation	432.8783
			F-statistic	185.5320
			Log likelihood	-785.7892
			Akaike AIC	15.10923
IIP(-2)	1597.547 (1061.81) [ 1.50455]		Schwarz SC	15.48613
			Mean dependent	8773.258
			S.D. dependent	2190.393
REPO_RATE(-1)	-29701.79 (38025.0) [-0.78111]			
REPO_RATE(-2)	3553.226 (36411.3) [ 0.09759]			
USD_INR(-1)	21.97654 (42.4136) [ 0.51815]			
USD_INR(-2)	-22.51256 (39.2865) [-0.57304]			
GOLD_PRICE (-1)	-0.022607 (0.04193) [-0.53916]			
GOLD_PRICE (-2)	0.091235 (0.04540)			

Figure 15: VAR Model

So here we observe that the model not only takes the present month values but also lag values to predict a model to find the impact of these macroeconomic variables on the NIFTY 50 index. We get a adjusted R square value of 96.09% which means that approximately 96% variations in NIFTY 50 can be described using the variations in macroeconomic factors using this model.

### Johansen's Co-integration Test

When we consider variables which are a time series, we need to consider how the independent variables affect the dependent variables in the long run. In this case, we have to check for existence of co-integration equations. We conduct this test in EViews and the look at the result through the Trace Test and Maximum Eigen Value Tests.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.431047	161.5726	125.6154	0.0001
At most 1 *	0.302962	102.3570	95.75366	0.0162
At most 2	0.251422	64.46087	69.81889	0.1242
At most 3	0.151981	34.05492	47.85613	0.4988
At most 4	0.102503	16.74548	29.79707	0.6588
At most 5	0.031056	5.390153	15.49471	0.7661
At most 6	0.019591	2.077517	3.841465	0.1495

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*Mackinnon-Haug-Michelis (1999) p-values

**Figure 16: Johansen's Co-integration - Trace Test**

Here in Trace Test, the Null Hypothesis is there exists no or at the most x co-integrating equations. From the above result table we can conclude that there exists 2 co-integrating equations at 5% significance level. The null hypothesis for no co-integrating equations and at most 1 are rejected.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.431047	59.21555	46.23142	0.0013
At most 1	0.302962	37.89613	40.07757	0.0863
At most 2	0.251422	30.40595	33.87687	0.1228
At most 3	0.151981	17.30944	27.58434	0.5535
At most 4	0.102503	11.35533	21.13162	0.6119
At most 5	0.031056	3.312636	14.26460	0.9238
At most 6	0.019591	2.077517	3.841465	0.1495

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level  
 \* denotes rejection of the hypothesis at the 0.05 level  
 \*\*Mackinnon-Haug-Michelis (1999) p-values

**Figure 17: Johansen's Co-integration - Maximum Eigen Value Test**

Here in Maximum Eigen Value Test, the Null Hypothesis is there exists no or at the most x co-integrating equations. From the above result table we can conclude that there exists 1 co-integrating equation at 5% significance level. The null hypothesis of no co-integrating equations are rejected.

This result concludes that there exists a long run relationship between the index NIFTY 50 and macroeconomics factors.

**Granger Causality Test**

Now that we have established a model and also determined that there exists a long term relationship between the variables, let us check for the causality between the variables. Causality is basically whether one variable is the reason behind causing the variations in the other variables. This can be tested using Granger Causality test in EViews.

Null Hypothesis:	Obs	F-Statistic	Prob.
CPI does not Granger Cause NIFTY_50 NIFTY_50 does not Granger Cause CPI	107	0.73653 0.09746	0.3927 0.7555
IIP does not Granger Cause NIFTY_50 NIFTY_50 does not Granger Cause IIP	107	6.75046 0.00981	0.0107 0.9213
REPO_RATE does not Granger Cause NIFTY_50 NIFTY_50 does not Granger Cause REPO_RATE	107	6.78121 0.91416	0.0106 0.3412
USD_INR does not Granger Cause NIFTY_50 NIFTY_50 does not Granger Cause USD_INR	107	4.95099 7.13672	0.0282 0.0088
GOLD_PRICE_PER_10_GRAMS does not Granger Cause NIFTY_50 NIFTY_50 does not Granger Cause GOLD_PRICE_PER_10_GRAMS	107	5.57094 1.18474	0.0201 0.2789
_10_YEAR_BOND_YEILD does not Granger Cause NIFTY_50 NIFTY_50 does not Granger Cause _10_YEAR_BOND_YEILD	107	1.98418 2.62113	0.1619 0.1085

**Figure 18: Granger Causality Test Results**

The null hypothesis are checked through the p-value at 5% significant level. We can conclude that IIP, Repo Rate, Exchange Rate and Gold Price Granger cause NIFTY 50. And NIFTY 50 Granger causes Exchange Rate.

## CONCLUSION AND POLICY IMPLICATIONS

The fluctuations seen in the stock market are a complex combination of various government policies and the reactions of the investors towards them. So we considered a range of macroeconomic factors to understand how they impact the stock market and how it is reflected in the NIFTY 50 index. We employed various tests and models to understand if and how these factors impact the index. These results can help in understand the stock market index fluctuations as well as investing patterns because of the macroeconomic factors and how it leads to generating returns.

The correlation test and linear regression, shows that at order one, except for IIP, all the other 5 macroeconomic factors have a significant correlation with the NIFTY 50 index. The regression model collectively considers the combination of the 6 macroeconomic factors to determine the impact on NIFTY 50. In that model, the exchange rate has weaker contribution as compared to the other variables.

But as observed through the R square value, a stronger model is required to understand the impact better as the variables used are time series. So a multivariate model is realized through the VAR model. So after testing for stationarity using the unit root test, we have created the VAR model. But just understanding the short term model is not enough, so we used the co-integration test to determine whether there is a long term relationship between the variables. We came to the result that there exist at least one co-integration equation. And then through Granger causality, we realized how various variables are responsible in causing the impact on NIFTY 50 index. Through this study, we have worked to create and show in various tests and models that the macroeconomic factors impact the stock market.

There can be few policy implications of the study. A low to moderate inflation rate is not harmful for the markets, and this may be done by a restricted increase in the prices of goods

that the markets can readily absorb. The government should maintain a tight eye on oil prices and the exchange rate.

However, the government must exercise extreme caution because price increases do not result in spiralling inflation but rather only a controlled level that may be advantageous for the markets. This will allow the government to cultivate a favourable reputation among the domestic and global investing communities.

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